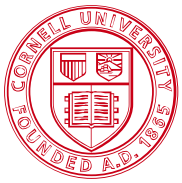

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Document Title:	Navigating Scientific Research
Author:	Laura Martin
Course:	Natural Resources 1200
Course Title:	Birds, Bats, Butterflies: The Art of Field Biology
Year of Award:	Fall 2014

Winner

Fall 2014 James Slevin Assignment Sequenc

We are pleased to invite applications for the James F. Slevin Assignment Sequence Prize. This prize of $500 will be awarded to the teacher submitting the best sequence of writing assignments for a First-Year Writing Seminar (second place winners, if any, will receive $150).

Assignment sequences in a writing course are built around a series of essay topics. These sequences probably represent work assigned during a portion of the course rather than all of the essay assignments distributed over an entire semester. Submissions should include a rationale and a description of your plans for eliciting and responding to student drafts and revisions, as well as a description of how you prepare students for each essay assignment, for example by engaging them in preparatory writing exercises, including informal writing designed to help students understand the material on which they subsequently write formal essays. Reflections on what worked well, and why, and what you would change another time, are welcome.

The winner will be announced to the Cornell community. Winning entries will be deposited in the Knight Institute's web accessible archive and made available to other instructors under a creative commons attribution, non-commercial license. (See creativecommons.org for more information about cc licensing.)

To facilitate future searching of the Institute's archive, we ask that you provide a brief descriptive abstract (about 75 words) of your document, and a short list of appropriate keywords that might not appear in the text. Examples might include terms like "rhetorical situation," "style," "citation," etc. **Any borrowings such as quotations from course texts or handbooks must be cited properly in the document itself.**

Submissions are due in 101 McGraw Hall by Friday, December 19. No exceptions can be made.

Fall 2014 James F. Slevin Assignment Sequence Prize Application

~Please Print Clearly. Do **not** staple. Use paper clips only~

Instructor's name LAURA MARTIN

Department NTRES Course # and title 1200 : BIRDS, BATS, BUTTERFLIES : THE ART OF FIELD ORNITHOLOGY

Home telephone _____ Student ID number _____

Should I win a prize, I give the John S. Knight Institute permission to publish, quote from, and/or distribute copies of the assignment sequence, and to distribute publicity to newspapers and other publications, local and/or national, about my winning the prize. I also grant the Knight Institute permission to deposit the assignment sequence in a web accessible archive and make it available under a creative commons attribution, non-commercial license. I am prepared to send electronic versions of my text to Donna O'Hora (dlo1@cornell.edu) in the Knight Institute. I understand that I will receive the award for my prize-winning sequence upon submission of the electronic text.

NAVIGATING SCIENTIFIC RESEARCH

Title of Assignment Sequence

Instructor's signature _____ Date 12/17/14

Laura Jane Martin
Department of Natural Resources
Cornell University
Ithaca, NY 14853

15 December 2014

Knight Writing Institute
101 McGraw Hall
Cornell University
Ithaca, NY 14853

Dear James F. Slevin Assignment Sequence Prize selection committee,

I am submitting a sequence of three assignments from my Fall 2014 FWS for your consideration.

In "Birds, Bats, Butterflies: The Art of Field Biology," I assigned texts by biologists, journalists, poets, fiction writers, historians, and anthropologists. Students learned about the practice of field biology through classroom discussions, in-class writing, and homework assignments. I designed the final sequence of take-home assignments, which I have titled "Navigating Scientific Research," to match the seminar's learning outcomes as stated in the syllabus:

> At the end of this semester students will submit a portfolio containing selections of work for this class in both first-draft and revised forms. The portfolio will demonstrate:
> • writing that appropriately uses argument, evidence, structure, and diction to engage its occasion and its genre
> • writing that is based on careful analytical reading
> • appropriate citation of primary and secondary sources
> • effective development through drafting, revising, and responding to critique

The three assignments are copied below, along with an explanation of the preparation for each assignment and the rationale behind it. I then reflect on what worked well about this sequence and what I would change in future semesters.

Abstract: This sequence of three assignments, designed for a FWS on field biology, familiarizes students with the structure of scientific journal articles, the workings of the academic peer review process, and the skills required to write a detailed scientific literature review.

Keywords: literature review, citation, annotated bibliography, peer review, scientific writing

Assignment 4: Annotated Bibliography

Preparation

Preparation for this assignment began early in the semester. On September 11, I took my class to a customized library orientation at Mann Library. In the orientation we emphasized strategies for locating scholarly articles and evaluating their credibility (NTRES1200 LibGuide: http://guides.library.cornell.edu/c.php?g=133210&p=870958). Because of my seminar's emphasis on biology, we focused on the Web of Science and Google Scholar search engines.

For October 2's class I assigned two articles from the journal *Nature* – an ecological article on the impact of climate change on mammals in Yosemite National Park and a summary of that article by a *Nature* staff writer. As groups of three and then as a class we compared the articles' structures. About half of my students had never read a scientific journal article. We continued the conversation in our next classroom session, October 7. For this class students were assigned two journal articles: an article from the journal *Ecology* that used data on flowering times from Thoreau's journals to model the ecological effects of climate change and an article from the journal *Nature* that argued for the re-introduction of large mammals to the U.S. West. Both echoed earlier readings: We had read excerpts from Thoreau's *Walden* on September 4, and a popular piece by one of the *Nature* co-authors, a Cornell professor, on September 30. I then lectured about the history of scientific journal conventions, drawing on research I did in 2012 for a blog piece (http://blogs.scientificamerican.com/guest-blog/2012/08/15/scientists-as-writers).

I handed out Assignment 4 on October 7. We read the assignment out loud and I asked students if they were familiar with bibliographies or annotated bibliographies. Most were not. We then discussed the ways in which scholars in different disciplines use bibliographies. Indeed, throughout the semester I made sure to explain that professional researchers completed the same types of tasks that I was asking students to complete. When I was an undergraduate, I had no clue why I was assigned annotated bibliographies. I considered them busywork. I was a first generation college student and had never met a researcher. Because of that experience I am committed to explaining to students my rationale behind each assignment.

For Assignment 4 I asked the students to choose a focal article from a list of twenty. This worked well: Students were able to choose a topic that interested them, and I was able to ensure that students read well-written articles with which I was familiar. Students were then assigned to annotate the focal paper along with four papers that it cited.

On October 16 I had students who had chosen the same or related papers discuss and exchange their annotated bibliographies with one another.

Rationale

(1) To introduce students to the structure of scientific articles; (2) To assess student comprehension of scientific articles; (3) To provide an occasion for students to use search engines to find articles cited by another scholar; (4) To discuss how and why scholars include citations in their articles.

NTRES1200
Fall 2014
Annotated Bibliography

Pick an article that interests you from the list of 20. This paper will be the basis of Essays 5 and 6. Read the article carefully, and also read four articles cited in the article. Then create an annotated bibliography of the five sources.

What is an annotated bibliography?

A bibliography is a list of sources (books, journals, periodicals, etc.) one has used for researching a topic. Bibliographies are sometimes called "References" or "Works Cited" depending on the style format you are using. A bibliography usually just includes the bibliographic information (i.e., the author, title, publisher, etc.).

An annotation is a summary and evaluation.

An annotated bibliography includes a summary and/or evaluation of each of the sources. Annotated bibliographies are used in various scientific and humanistic disciplines as guides to important literature.

Example entry from an annotated bibliography:

> Heller, N. E. and E. S. Zavaleta (2009). "Biodiversity management in the face of climate change: A review of 22 years of recommendations." Biological Conservation 142(1): 14-32.
>
> This article is a review of published literature on recommendations for management of biodiversity in the face of climate change. It provides a list of more than 100 different management recommendations, and the articles from which they are drawn. The authors, both ecologists, rank management recommendations based on how common they are. For example “increase connectivity” is the most common, found in 24 articles, while many are unique to only one or a few studies. There is also a discussion of the appropriate scales for many of the recommended actions. The language is non-technical and the article is very readable. This article will be useful in pointing me to other important articles that address both biodiversity management and climate change. For example, I plan to read Sala *et al.* (2010).

Your annotated bibliography is **due in-class (hard copy) and online on 10/16/14.** Cite the book, article, or document in the *Chicago Manual of Style* citation style. Then write a concise annotation that summarizes the central theme and scope of the book or article. Include one or more sentences that (a) explain the scope of the paper, (b) comment on the intended audience and purpose, (c) compare or contrast this work with another you have cited, or (d) explain how this work illuminates your bibliography topic.

NTRES1200
Fall 2014
List of Publications for Annotated Bibliography

Susan Cook-Patton and Anurag A. Agrawal, "Exotic Plants Contribute Positively to Biodiversity Functions but Reduce Native Seed Production and Arthropod Richness," *Ecology* 95 (2014): 1642-1650.

Todd E. Minchinton and Mark D. Bertness, "Disturbance-Mediated Competition and the Spread of *Phragmites Australis* in a Coastal Marsh," *Ecological Applications* 13 (2003): 1400-1416.

Thomas A. Kursar *et al.*, "The Evolution of Antiherbivore Defenses and Their Contribution to Species Coexistence in the Tropical Tree Genus *Inga*," *Proceedings of the National Academy of Sciences* 106 (2009): 18073-18078.

Antonio DiTommaso *et al.*, "Deer Browsing Delays Succession by Altering Aboveground Vegetation and Belowground Seed Banks," *PLoS One* 9: e91155.

Harry W. Greene and Roy W. McDiarmid, "Coral Snake Mimicry: Does it Occur?" *Science* 213 (1981): 1207-1212.

Janet Foley *et al.*, "Investigating and Managing the Rapid Emergence of White-Nose Syndrome, a Novel, Fatal, Infectious Disease of Hibernating Bats," *Conservation Biology* 25 (2011): 223-231.

Elise Zipkin *et al.,* "When Can Efforts to Control Nuisance and Invasive Species Backfire?" *Ecological Applications* 19 (2009): 1585-1595.

Nick Haddad and John Tewksbury, "Low Quality Habitat Corridors as Movement Conduits for Two Butterfly Species," *Ecological Applications* 15 92005): 250-257.

Durrell D. Kapan, "Three-Butterfly System Provides a Field Test of Mullerian Mimicry," *Nature* 409 (2001): 338-340.

Sean B. Menke *et al.*, "Urban Areas May Serve as Habitat and Corridor for Dry-Adapted, Heat Tolerant Species; an Example from Ants," *Urban Ecosystems* 14 (2011): 135-163.

Laura Eierman and Richard C. Connor, "Foraging Behavior, Prey Distribution, and Microhabitat Use by Bottlenose Dolphins *Tursiops Truncatus* in a Tropical Atoll," *Marine Ecology Progress Series* 503 (2014): 279-288.

Dana Warren *et al.*, "Status and Distribution of Fish in an Acid-impacted Watershed of the Northeastern United States," *Northeastern Naturalist* 15 (2008): 375-390.

Aurelie Coulon *et al.*, "Effects of Habitat Fragmentation on Effective Dispersal of Florida Scrub-Jays," *Conservation Biology* 24 (2010): 1080-1088.

Yves Basset *et al.*, "Cross-continental Comparisons of Butterfly Assemblages in Tropical Rainforests: Implications for Biological Monitoring," *Insect Conservation and Diversity* 6 (2013): 223-233.

John Reid *et al.*, "Artificial Bat Roosts Did Not Accelerate Forest Regeneration in Abandoned Pastures in Southern Costa Rica," *Biological Conservation* 167 (2013)" 9-16.

Nicholas Bryant Elliot *et al.*, "Movements Vary According to Dispersal Stage, Group Size and Rainfall: The Case of the African Lion," *Ecology*, in press, http://dx.doi.org/10.1890/13-1793.1

Roger Vila *et al.*, "Phylogeny and Palaeoecology of *Polyommatus* Blue Butterflies Show Beringia was a Climate-regulated Gateway to the New World," *Proceedings of the Royal Society B*, published online 26 January 2011, doi: 10.1098/rspb.2010.2213.

Rayna C. Bell and Kelly R. Zamudio, "Sexual Dichromatism in Frogs: Natural Selection, Sexual Selection and Unexpected Diversity," *Proceedings of the Royal Society B*, published online 19 September 2012, doi: 10.1098/rspb.2012.1609.

Çağlar Akçay *et al.*, "Vocal Kin Recognition in Kin Neighborhoods of Western Bluebirds," *Behavioral Ecology* 24 (2013): 898-905.

Caren Cooper *et al.*, "Natural History Traits Associated with Detecting Mortality Within Residential Bird Communities: Can Citizen Science Provide Insights?" *Environmental Management* 50 (2012): 11-20.

Assignment 5: Peer-Review Letter

Preparation

On October 21 I handed out the instructions for assignment 5, a peer-review letter addressed to the editor of the article students annotated for assignment 4. In class we discussed the academic peer review process and read example reviews. I emphasized the parallels between our class's peer editing and academic peer review.

Class peer review took two forms. The first was a daily workshop. Each student signed up for a workshop day between October 2 and December 4. Five days before a student's workshop, he or she was responsible for posting 2-3 pages of writing on Blackboard. It could be any piece of writing, including an assignment for our course. The designated student provided a brief explanation of the piece (occasion, audience) and asked the rest of the class to address two questions. The other 17 students then read the piece before class and answered the two questions on Blackboard. In class we spent 20 minutes discussing the student's excerpt.

I modeled the workshop after creative writing workshops, in which students discuss a piece as if the author were not in the room. That way, students don't default to asking the author what he or she means. Instead, they focus on how to improve the piece in front of them. At the beginning of the semester I stressed the importance of making workshop a positive and safe space. In the second week of class I handed out a worksheet on Peer Editing Guidelines. I facilitated the workshop and used it as an occasion to emphasize in-class units (e.g. concision, paraphrase, conjunctive adverbs).

During the week of October 21 students met with a randomly assigned partner outside of class to exchange a draft of one of the essays for this course. After reading one another's pieces, they spent 20 minutes per person discussing what that person could do to improve the essay, and ~20 minutes writing notes on their partner's suggestions.

On October 23 I returned the annotated bibliographies with written feedback. In class we discussed a handout on active sentences. We read examples of passive voice and nominalization from readings assigned earlier in the semester. We then broke into groups to complete an in-class exercise on active-voice writing. I gave students three passages and asked them to identify each sentence's character and action. They then had to reformulate the sentences into active sentences.

Rationale

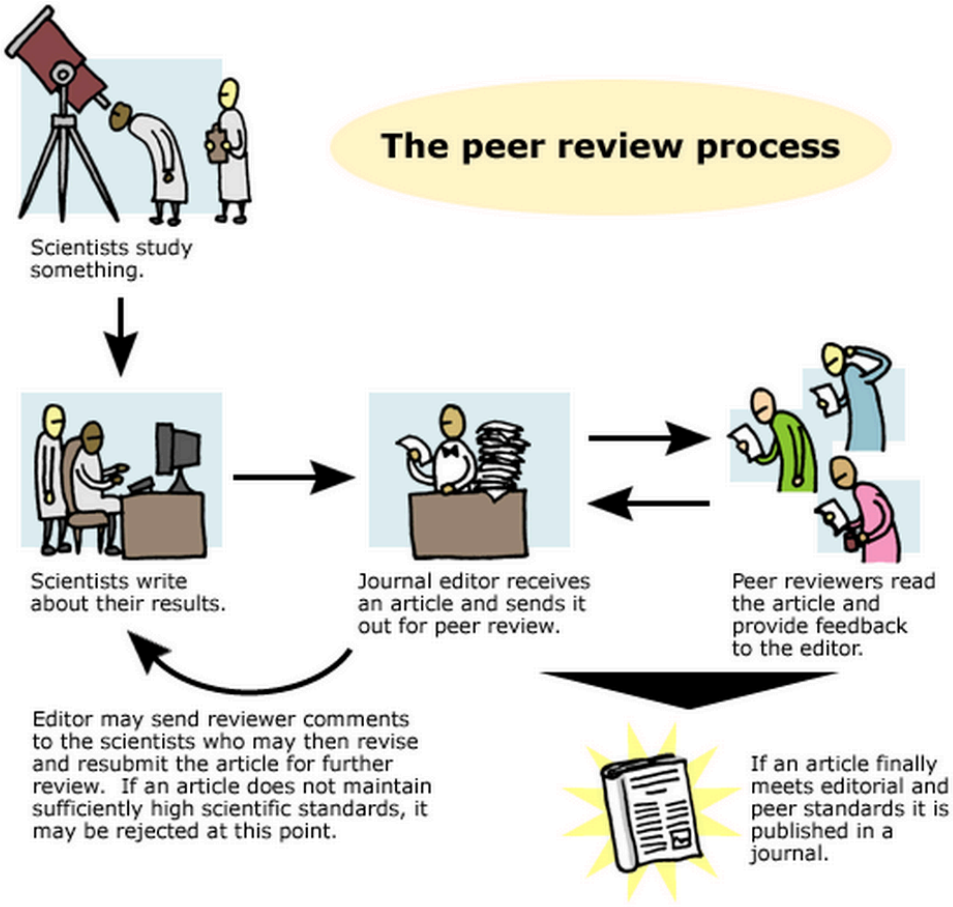
My goal in teaching is to position students as active learners. Many students are trained to approach the classroom as a place to receive knowledge. I want to undo this training – to make the classroom instead a place where students generate knowledge of themselves, their abilities, and the world. I strive to empower students to see themselves as members of both a campus intellectual community and an international, intergenerational one. The goals of assignment 5 were (1) To reinforce in-class lessons about how to provide peers with useful reviews; (2) To empower students to see themselves as peers of scientists; (3) To discuss the relationship

between structure and content; (4) To emphasize the idea that even published papers can be improved through revision.

NTRES1200
Fall 2014
Scientific Peer Review

Imagine that a journal editor has requested that you peer-review the focal article you chose for your annotated bibliography. Write a formal letter to the paper's author(s) in which you:

(1) identify the paper's greatest strengths and weaknesses
(2) recommend revisions – how should the authors change the paper's organization, methods, arguments, and/or conclusions.



Peer review and publication are time-consuming, frequently involving more than a year between submission and publication. The process is also highly competitive. For example, the highly-regarded journal *Science* accepts less than 8% of the articles it receives, and *The New England Journal of Medicine* publishes just 6% of its submissions.

For example peer review letters, see: http://www.peerageofscience.org/review/review-examples/

Note: These example letters are written by experts on their respective topics. Don't worry about critiquing technical and methodological aspects of the article you have chosen. Instead, focus on structure of its arguments and other aspects of writing.

On the process of writing scientific peer review letters, see also:
http://www.phd2published.com/2012/05/09/how-to-write-a-peer-review-for-an-academic-journal-six-steps-from-start-to-finish-by-tanya-golash-boza/
http://violentmetaphors.com/2013/12/13/how-to-become-good-at-peer-review-a-guide-for-young-scientists/

Strive for specificity in your recommendations. Some examples:

Unhelpful comment: "The methods section needs work."

Helpful Comment: "This section discusses both animal-rearing conditions and experimental methods, but the two are mixed together. Could you separate each into its own paragraph?"

Unhelpful comment: "How are these references relevant?"

Helpful Comment: "The background and references given in paragraph 2 don't seem directly relevant to the hypothesis. I think the authors need to include references on how light has been shown to affect flowering (in sunflower or any species), and less on other factors that promote or inhibit flowering."

Unhelpful comment: "The conclusion is unclear."

Helpful Comment: "I'm not sure what your interpretation is after these two paragraphs: does the experiment show that mung beans cure cancer, or not? Which are the authors concluding? If the sample size is too small, the authors need to discuss that when they suggest future research."

This letter (~ 3 pages) is **due in-class (hard copy) and online on 10/30/14**.

Assignment 6: Literature Review

Preparation

On November 6 I returned written comments on assignment 5. I then held conferences to discuss students' progress on assignment 6.

In the final weeks of the course I used classroom time to work on three skills that I knew would be important for assignment 6: positioning, citation, and synthesis.

In earlier assignments I had noticed many students struggling to distinguish their voice from the voices of those they were summarizing. Thus on November 11 we read an excerpt from Gerald Graff and Cathy Birkenstein, *"They Say, I Say," The Moves that Matter in Academic Writing* (NY: W. W. Norton & Co.) that focused on using what others say, or might say, as a launching point for one's own views. The students found this article useful and many continued to use the phrase "They say, I say" throughout the semester.

I also continued to develop new handouts and in-class assignments on when to cite. I knew from the Knight Institute's plagiarism quiz that many of my students did not understand when and how to cite. This, I knew, would be crucial to Assignment 6 (and the rest of their college careers). One of my favorite handouts was "When Should I Quote?," which I adapted from material from the University of Wisconsin-Madison's Writers Handbook and the University of North Carolina Writing Center. We refered to this handout throughout the semester.

Finally, I developed in-class prompts as occasions for practicing synthesis. On November 25, for example, we listened to a Radiolab podcast on invasive species in the Galapagos. I then had students spend ten minutes free writing about the connections between the podcast and the bigger themes that were emerging in the course. We then read some of the students' responses out loud and discussed the difference between summary and synthesis. The mode of synthesis employed in scientific literature reviews parallels that in other disciplines, where students must position themselves as participants in a larger academic conversation.

Rationale

Literature reviews are a type of article that a scientist is likely to encounter early and often in his or her career. They are also similar in purpose to the "Introduction" section of research articles. This assignment provided students with an occasion to engage in scientific writing without requiring them to do original experimentation. My goals in crafting this assignment were (1) To provide students with an occasion to write a long (~10 page) essay, and thus to demonstrate organizational skills we had worked on throughout the semester; (2) To continue lessons on positioning, citation, and synthesis; (3) To position students as active participants in a broader academic community.

NTRES1200
Fall 2014
Literature Review

In your annotated bibliography, you began to research a topic within the realm of field biology. In your peer-review letter, you practiced summarizing and analyzing this research. This essay – a literature review – builds upon these previous assignments.

In ~8 pages, explain how the five papers from your annotated bibliography, and three additional papers, relate to one another. Beyond summarizing the papers, identify gaps in the research on this topic. Pick one of these gaps and propose it as a question for future research. Be sure to try to convince your readers that the question you propose should be researched. Provide a few examples of how it could be researched.

A literature review has an organizational pattern and combines both summary and synthesis. A summary is a recap of the important information of the source, but a synthesis is a re-organization, or a reshuffling, of that information. It might give a new interpretation of old material or combine new with old interpretations. Or it might trace the intellectual progression of the field, including major debates. And depending on the situation, the literature review may evaluate the sources and advise the reader on the most pertinent or relevant.

For an example literature review, see:

http://www.ithacalibrary.com/sp/assets/users/_lchabot/lit_rev_eg.pdf

For strategies on writing literature reviews, see:

http://www.ploscompbiol.org/article/info%3Adoi%2F10.1371%2Fjournal.pcbi.1003149
http://writingcenter.unc.edu/handouts/literature-reviews/ http://ocw.mit.edu/courses/biology/7-16-experimental-molecular-biology-biotechnology- ii-spring-2005/scientific-comm/lec05_mpominirev.pdf

Essay 5 is **due in-class (hard copy) and online on 11/20/14**.

Reflections on Sequence

This sequence was highly successful. Not only did it get many students interested in field biology, but it provided an occasion to practice the reading and writing skills I had emphasized throughout the semester.

Assignments 4 and 5 served as "check points" to ensure that students were making progress towards assignment 6, the longest essay of the semester.

Assignment 4 required students to employ the methods they had used in our library session to find specific articles. I found this to be a much more useful task than asking students to find *any* articles on their subject. Many students struggled to find particular articles. They reached out to each other, me, and the library staff to find them. In this way they learned how to read citations and how to track original sources. They were also able to evaluate why an author had included a particular citation.

Assignment 5 required students to position themselves as the peers of experts in field biology. Many students worried that they would be unable to find anything to critique in a published, expert scientific article. Those students were then empowered when, indeed, they were able to use language from our in-class workshops to constructively criticize these published articles.

In their final self-evaluation letters, students emphasized their appreciation for their peer review experiences:

> "When I had my first writing meeting and writing workshop, I learned that whenever I revise my paper I should see through the reader's perspective. By asking my friends to revise my essays, I realized that I should not assume that my readers would understand everything I write."
>
> "Activities like the concision exercises and the weekly workshop have helped me learn to make my voice more authoritative in my writing, and have allowed me to become a better editor for my peers. I know that these skills will extend beyond this class throughout the rest of my college career."
>
> "The workshops gave me a chance to see what weaknesses were universal to everyone's writing, as well as each person's unique opinion on the best way to express and organize ideas. By helping others edit, I became a better editor for my own papers, and the continuous practice of editing and commenting on others' papers helped me develop the habit of editing my own as well. Lastly, hearing all of the helpful comments during workshop actually made me more excited to go back and edit my own paper, because I could see how much more my paper could improve based on all of the useful suggestions my classmates gave me."
>
> "I felt that the writing workshops were an amazing resource when practicing concision as it's easier to critique essays other than your own to get more comfortable with writing. Now I actively look for ways to shorten my essays to the best of my ability to make the meaning of

each sentence impactful. This was the first time I was exposed to workshops where I edit other's essays, and that is how I would say my editing skills have improved the best."

Assignment 6 emphasized the difference between summary and synthesis. I was deeply impressed with many of the intellectual questions that students generated from their reviews. A few examples:

> "As summarized above, there are still a number of unanswered questions concerning the coral snake mimicry hypothesis. […] Coral snakes are found throughout much of South America and Central America, but in the U.S. they are not found north of the Carolinas, Louisiana and Texas. Coral snake mimics, however, are found throughout most of the U.S. up to the Canadian border. A number of theories have been presented to explain the large area of mimics without models, but very little research has been done on this unknown issue. One possibility to explain the continuing mimicry is the migration of predators. Field observations should be undertaken to determine if hawks and other coral snake predators regularly migrate from areas where actual coral snakes are found."

> "If there is a positive link between exotic plant diversity and generalist insect performance, what would that mean for the food chain and hierarchies within the ecosystem? What would happen to specialized insects in comparison to generalist insect counterparts within the ecosystem? These questions, when explored further, can reveal more about the nature of exotic plant species within native ecosystems."

> "Because this is such a large important gap in the research, a team of scientists should conduct an experiment to determine the aforementioned long-term effects. An appropriate experiment would be one in which the community diversity varied in several artificially controlled communities. These communities could then be monitored for decades and have the progress noted. The important things to look for over this long period of time are the expansion of the exotic plants and the general health of the native's plants in comparison to the control."

In future semesters, I would make a first draft of assignment 6 due a week or two earlier and require students to provide a second draft of assignment 6. My course was portfolio based, and students had to include three revised assignments in their portfolios, but not necessarily assignment 6. A few students therefore waited until the end of the semester to submit assignment 6 who would have benefitted from feedback.